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Prevalence and Correlations of Premenstrual Dysphoric Disorder: A Sample of Adult Working Women

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Abstract

Background: Premenstrual dysphoric disorder (PMDD) represents a significant psychiatric condition affecting women of reproductive age. It is characterized by cyclical emotional and physical symptoms that considerably impair psychosocial functioning. This study aims to investigate the prevalence of PMDD among adult working women and identify associated etiological factors.

Methods: From January 2022 to March 2022, a cross-sectional study utilizing cluster sampling methodology was conducted to investigate the prevalence of PMDD among adult working women in six communities in Hangzhou (China). A total of 1710 participants were selected for research through a questionnaire-based survey. To elucidate the factors associated with PMDD, logistic regression analysis was employed.

Results: Among 1710 working women, 52 had PMDD, representing an incidence of 3.04%. Age (odds ratio (OR) = 3.196, $p = 0.002$), age at menarche (OR = 0.362, $p = 0.011$), income (OR = 0.449, $p = 0.043$), menstrual cycle (OR = 2.352, $p = 0.022$), menstrual symptoms (OR = 0.317, $p = 0.003$), physical activity (OR = 2.234, $p = 0.028$), and caffeine intake (OR = 2.318, $p = 0.022$) were independent influencing factors of PMDD in adult working women.

Conclusions: The study highlights that PMDD, which has a prevalence of 3.04% in the surveyed population, is a notable concern among adult working women. Key factors, such as age, age at menarche, income level, menstrual cycle characteristics, menstrual symptom presence, phys-

ical activity, and caffeine intake, significantly contribute to the likelihood of developing PMDD. These findings underscore the importance of recognizing and monitoring the above risk factors by clinicians to identify and manage PMDD in working women.

Keywords

premenstrual anxiety disorder; influencing factors; adult working women; prevalence; multiple factor analysis

Introduction

Premenstrual dysphoric disorder (PMDD) is characterized by recurrent, cyclical, affective, and somatic symptoms that exacerbate during the late luteal phase of the menstrual cycle and remit with the onset of menstruation [1]. It is a common psychological disorder among women of reproductive age [2]. The clinical manifestations of PMDD encompass emotional instability, mental disorder, appetite loss, insomnia, and systemic pain. These manifestations can significantly affect the patient's quality of life and work.

Adult working women are a high-risk group of PMDD [3]. The etiology of PMDD in this population is multifactorial, with occupational stress and anxiety serving as significant contributing factors. Epidemiological study indicates that PMDD affects approximately 2%–5% of women of reproductive age [4]. Sasaki *et al.* [5] believed that workplace, occupational factors, and social support have remarkable effects on the manifestation of premenstrual anxiety among adult working women. However, our understanding of this culturally specific disorder remains limited [6]. A recent study demonstrated that menstrual health issues can have profound societal implications, significantly impacting the physical and psychological well-being of adolescent females [7]. While premenstrual syndrome (PMS) and PMDD are common conditions, they are often under-

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diagnosed and undertreated in clinical practice, highlighting the need for increased awareness and improved diagnostic protocols.

This study aims to investigate the prevalence and associated factors of premenstrual anxiety in professional women, addressing a gap in the current literature, which has predominantly focused on student populations. This study is motivated by the growing recognition of psychosocial determinants in mood-related disorders. By examining premenstrual anxiety in the context of professional women, this study holds substantial practical and social implications. Elucidating the prevalence and influencing factors of PMDD among professional women is crucial for the development of effective interventions and support systems. Such approaches can improve the health status and quality of life of professional women, simultaneously providing essential guidance for clinical practice and public health policies.

Materials and Methods

Subjects of the Study

This work is a cross-sectional study. From January 2022 to March 2022, cluster sampling was used to conduct a questionnaire survey of adult working women in six communities in Hangzhou City. A total of 1771 questionnaires were collected, and 1710 questionnaires were finally included with a response rate of 96.56%.

The inclusion criteria were as follows: (1) adult working women, (2) absence of mental disorders, (3) provision of signed informed consent and voluntary participation. The exclusion criteria were as follows: (1) presence of other severe organic diseases, (2) poor cooperation in the survey, (3) pregnant and lactating women, (4) use of hormonal contraceptives and substance abuse. The study protocol was approved by the Clinical Trial Ethics Review Committee of Shulan (Hangzhou) Hospital (approval number: KY2023018). This study was conducted in accordance with the principles outlined in the Declaration of Helsinki.

Sample Size Calculation

This study used a cross-sectional study design with prevalence as the primary outcome measure. The expected prevalence of the disease in the target population ranged from 3.00% to 8.00% [8]. Given a significance level (α) of 0.05, the allowable error (δ) of $0.1 \times p$, and an unknown

total population, the required sample size was calculated using the following computational formula [9]: $n = \{Z2\alpha/2 \times [p] \times [1 - p]\}/\delta^2$.

Based on this calculation, the estimated required sample size was approximately 1534 participants. Considering a sample attrition rate of 5%, 1771 individuals were included. This sample size was deemed sufficient to ensure adequate statistical power for the investigation.

Quality Control

Before the survey, the investigators underwent standardized training and were required to meet predetermined qualification criteria to participate in the survey. During the survey, investigators explained the questionnaire to the target population. Respondents provided verbal responses, which were then transcribed onto the questionnaire forms by the trained investigators. Questionnaires were collected on-site, and the questionnaires of those who were unsure about the content of the survey and those with communication barriers were regarded as invalid to ensure the accuracy of information.

General Information

Demographic and physiological data were collected from participants, including age, age at menarche, body mass index (BMI), workplace, educational level, interpersonal relationships, socioeconomic status, marital status, fertility, menstrual cycle characteristics, menstrual symptomatology, physical activity levels, and caffeine intake.

The menstrual cycle was defined as follows: “Regular” denoted a menstrual cycle with consistent periodicity and stable intermenstrual intervals, typically exemplified by a 28-day cycle with minimal month-to-month variability. Conversely, “Irregular” was defined as a menstrual cycle characterized by unstable intermenstrual intervals, variable cycle lengths, and unpredictable changes, possibly leading to shortened or prolonged cycles.

Physical activity was defined based on the frequency and duration of participation in sports or exercise. “Regular” refers to engaging in physical activity with a consistent frequency and duration in accordance with a planned or periodic schedule, such as exercising for a fixed number of days per week or for a set amount of time each day. Conversely, “Irregular” indicates an inconsistent frequency and duration of physical activity, lacking a fixed plan or schedule, and potentially involving sporadic or intermittent participation.

Interpersonal relationships are defined as interactions and communication between two or more individuals. The quality of these relationships was categorized as follows: (1) “Good” signified positive and harmonious relationships characterized by mutual support, understanding, and respect, (2) “Average” indicated relationships with moderate levels of interaction and communication, but may lack depth or frequency and could also involve some coldness or distance, (3) “Poor” suggested tense and conflict-ridden relationships with a lack of trust and support, possibly involving hostility or noncooperation.

Menstrual symptoms encompass a range of physiological and psychological alterations that women may experience in the premenstrual phase or during menstruation. “Normal symptoms” are defined as common and mild manifestations associated with the menstrual cycle. These typically include mild mood fluctuations, breast tenderness, and mild fatigue. “Abnormal symptoms” indicate severe or unusual symptoms experienced during the menstrual cycle. These may include severe mood fluctuations, intense pain, severe fatigue, or depression.

Mini International Neuropsychiatric Interview Version Plus

The Mini International Neuropsychiatric Interview-Plus (M.I.N.I.-Plus) was used to obtain current information on the presence of PMDD and other psychiatric disorders. It is a short structured diagnostic interview developed for DSM-IV and ICD-10 psychiatric disorders [10]. Psychological and somatic symptoms of the patients were retrospectively assessed using the M.I.N.I. scale, in accordance with DSM-IV criteria, for the one week preceding menstruation. In this study, the interviews were conducted by trained psychologists. The M.I.N.I.-Plus demonstrates high inter-rater reliability, with a Kappa coefficient of 0.82, thus ensuring robust consistency and reliability of assessments across different interviewers.

Statistical Methods

Statistical analyses were conducted using SPSS 25.0 (IBM Corporation, Armonk, NY, USA). To address the substantial disparity in sample sizes between the No-PMDD and PMDD groups, a random sampling method was employed to select 200 samples from the No-PMDD group, ensuring balanced group sizes and mitigating potential statistical bias. Chi-square tests and binary logistic regression analyses were performed to evaluate the effect of various variables on PMDD. Categorical data were expressed in the

form of (n, %) and analyzed using chi-square tests. Variance inflation factor and tolerance were used to conduct collinearity diagnostics on the indicators with statistical differences in univariate analysis. Binary logistic regression was employed to identify factors influencing PMDD. Variables demonstrating statistical significance in univariate analysis were included in the regression model. Statistical significance was set at $p < 0.05$.

Results

Incidence of PMDD

Among 1710 adult working women, 52 had premenstrual anxiety disorder, representing an incidence of 3.04%.

Incidence of PMDD in Adult Working Women and Comparison of General Data between Groups

Adult working women were categorized into two groups (the PMDD and No-PMDD groups) based on the occurrence of PMDD. Analysis of variance revealed significant associations ($p < 0.05$) between premenstrual anxiety and several variables, including age, menarche onset, socioeconomic status, menstrual cycle characteristics, menstrual symptomatology, physical activity levels, and caffeine intake, as shown in Table 1.

Analysis of the Influencing Factors of Premenstrual Anxiety in Adult Working Women

Collinearity diagnostics were conducted on variables exhibiting significant differences in univariate analysis, including age, age at menarche, income, menstrual cycle, menstrual symptoms, physical activity level, and caffeine intake. The results indicated no collinearity issues among these seven indicators, as shown in Table 2. Subsequently, these variables were incorporated into a binary logistic regression model. The analysis revealed that all seven variables—age, age at menarche, income, menstrual cycle, menstrual symptom severity, physical activity level, and caffeine intake—were independent influencing factors of premenstrual anxiety in adult working women ($p < 0.05$), as presented in Table 3.

Discussion

The findings of this study demonstrated that multiple independent variables, including age, age at menarche, income, menstrual cycle characteristics, menstrual symp-

Table 1. Comparison of the general data between the two groups of adult working women.

Variable	PMDD group	No-PMDD group	χ^2	<i>p</i>
	(n = 52)	(n = 200)		
Age (years)			7.108	0.029
18–28	12 (23.08%)	29 (14.50%)		
29–38	15 (28.84%)	35 (17.50%)		
39–45	25 (48.08%)	136 (68.00%)		
Age at menarche (years)			9.111	0.011
9–12	19 (36.54%)	88 (44.00%)		
13–14	18 (34.62%)	32 (16.00%)		
15–17	15 (28.84%)	80 (40.00%)		
Body mass index score (kg/m ²)			0.566	0.452
No	23 (44.23%)	77 (38.50%)		
Yes	29 (55.77%)	123 (61.50%)		
Workplace			2.590	0.274
Enterprise unit	20 (38.46%)	66 (33.00%)		
Government units	22 (42.31%)	73 (36.50%)		
Public institutions	10 (19.23%)	61 (30.50%)		
Educational level			2.882	0.4101
Junior high school and below	10 (19.23%)	31 (15.50%)		
High school	13 (25.00%)	38 (19.00%)		
Bachelor's degree	13 (25.00%)	74 (37.00%)		
Master's degree and above	16 (30.77%)	57 (28.50%)		
Interpersonal relationships			3.807	0.149
Good	23 (44.23%)	74 (37.00%)		
Average	20 (38.46%)	105 (52.50%)		
Poor	9 (17.31%)	21 (10.50%)		
Income (CNY/month)			14.648	0.002
≤3000	15 (28.85%)	25 (12.50%)		
3001–5000	14 (26.92%)	38 (19.00%)		
5001–10,000	12 (23.08%)	44 (22.00%)		
>10,000	11 (21.15%)	93 (46.50%)		
Marital			1.007	0.316
Unmarried/divorced/widowed	24 (46.15%)	77 (38.50%)		
Married	28 (53.85%)	123 (61.50%)		
Fertility			3.501	0.061
No child	29 (55.77%)	139 (69.50%)		
Have children	23 (44.23%)	61 (30.50%)		
Menstrual cycle			4.717	0.030
No regularity	34 (65.38%)	97 (48.50%)		
Regularity	18 (34.62%)	103 (51.50%)		
Menstrual symptoms			5.327	0.021
Normal symptoms	19 (36.54%)	109 (54.50%)		
Abnormal symptoms	33 (63.46%)	91 (45.50%)		
Physical activity			11.180	0.001
No regularity	34 (65.38%)	79 (39.50%)		
Regularity	18 (34.62%)	121 (60.50%)		
Caffeine intake (cups/day)			6.897	0.032
0	12 (23.08%)	60 (30.00%)		
1–4	18 (34.62%)	92 (46.00%)		
>4	22 (42.31%)	48 (24.00%)		

Note: PMDD, premenstrual dysphoric disorder. The exchange rate is 1 USD = 6.48 CNY.

Table 2. Covariance diagnosis.

Variables	Age	Age at menarche	Income	Menstrual cycle	Menstrual symptoms	Physical activity	Caffeine intake
Tolerance	0.949	0.819	0.933	0.900	0.873	0.888	0.953
VIF	1.054	1.220	1.072	1.111	1.146	1.126	1.049

Note: VIF, variance inflation factor.

Table 3. Binary logistics regression analysis.

Variables	Beta	S.E	Wald	<i>p</i>	Exp (B)	OR (95% CI)
Age (reference: <39)	1.162	0.368	9.947	0.002	3.196	1.552–6.579
Age at menarche (reference: >12)	-1.016	0.400	6.466	0.011	0.362	0.165–0.792
Income (reference: ≤10,000)	-0.802	0.396	4.097	0.043	0.449	0.206–0.975
Menstrual cycle (reference: regular)	0.855	0.373	5.248	0.022	2.352	1.132–4.890
Menstrual symptoms (reference: abnormal symptoms)	-1.149	0.388	8.789	0.003	0.317	0.148–0.677
Physical activity (reference: regular)	0.804	0.365	4.848	0.028	2.234	1.092–4.567
Caffeine intake (reference: 0–4)	0.841	0.368	5.207	0.022	2.318	1.126–4.773

Note: Dependent variable coding: 1 = PMDD group, and 0 = No-PMDD group. OR, odds ratio; CI, confidence interval.

tomatology, physical activity levels, and caffeine intake, were statistically significant influencing factors of PMDD in adult working women. Contemporary society has witnessed an increase in both the labor participation rate of women and the prevalence of women in prominent positions [11]. Within the context of advancing gender equality, women are gradually entering diverse career development trajectories [12]. PMDD is classified as a psychological disorder with an etiology that remains largely elusive [13]. Female professionals who experience prolonged periods without adequate emotional support may be susceptible to elevated stress levels and subsequent psychological disturbances. At the workplace, women generally report higher perceived stress levels compared to their male counterparts in equivalent positions, potentially predisposing them to the development of PMDD [14].

The results of this study show that age is an independent influencing factor of PMDD in adult working women. As women progress through adulthood, they encounter escalating stressors encompassing occupational, familial, and societal domains. The chronic suppression of emotional expression may manifest as inexplicable anxiety and irritability during menstruation, culminating in PMDD symptomatology. Previous research has examined anxiety levels in adult women, revealing a positive correlation between age and anxiety severity [15]. This finding is consistent with the conclusion of the present study, which indicates that the incidence of PMDD increases proportionally with age in adult working women. As women progress through their reproductive years, many establish families and have children, potentially leading to life stressors and, consequently, a higher incidence of PMDD. In addition, physiological fac-

tors, such as hormonal changes, play a crucial role in the etiology of PMDD. Women experience substantial hormonal fluctuations during different physiological stages, such as pre- and post-menopause. Such fluctuations may lead to emotional instability and increase the risk of PMDD. Research has demonstrated that fluctuations in estrogen and progesterone levels during different phases of the menstrual cycle exert a remarkable effect on mood and behavior [16]. Changes in hormone levels may cause instability in neurotransmitter release, thereby affecting mood regulation [17]. Other health conditions, such as thyroid diseases, depression, or anxiety, which may exacerbate PMDD symptomatology, were not sufficiently controlled in this study. Future research should employ a more rigorous methodology to account for these factors, thereby enhancing our understanding of PMDD etiology and manifestation in adult working women.

This study confirmed that age at menarche serves as an independent factor of premenstrual anxiety in adult working women. Specifically, early-onset menarche demonstrates a significant positive correlation with the prevalence of PMDD. Czajkowska *et al.* [18], consistent with Dinh *et al.* [2], elucidated a statistically significant association between premenstrual syndrome and age at menarche. Early menarche may be indicative of accelerated development of the female reproductive system, potentially triggering a series of changes in hormone levels. Hormonal fluctuations during the menstrual cycle affect the release of neurotransmitters, which may be associated with mood regulation. Early menarche has been associated with dysregulation of menstrual cycle and an elevated risk of premenstrual mood symptoms. Furthermore, early menarche may cause

women to experience life changes and challenges at an early age. These events have the potential to exert a substantial influence on psychological well-being. For example, environmental factors within education settings and psychosocial stressors may contribute to the development of anxiety symptoms.

This study confirmed that income serves as an independent influencing factor of PMDD in adult working women, demonstrating a significant negative correlation with PMDD prevalence. These findings align with the observations reported by de Carvalho *et al.* [19]. PMDD is common in people of lower socioeconomic status. People with low income typically experience a diminished overall quality of life and disproportionate income and remuneration. Therefore, they experience different levels of anxiety, which may contribute to an elevated incidence of PMDD. In contrast, individuals in the high-income group, who typically receive commensurate remuneration for their efforts, generally exhibit optimistic dispositions, demonstrate enhanced receptivity to others' perspectives, and garner appreciation from their employers. Consequently, their anxiety levels tend to be lower. However, it is imperative to consider additional related factors when interpreting the correlation between income on PMDD. First, individuals of lower socioeconomic status may encounter limited access to healthcare services and support systems. Insufficient medical resources might prevent them from receiving timely treatment and psychological support, potentially exacerbating their PMDD symptomatology. Second, the work environment may exert a considerable influence on the incidence and severity of PMDD. Low-income women may face significant work-related stress and unfavorable working conditions, which can increase their psychological burden and consequently trigger or exacerbate their PMDD. Therefore, in addition to addressing economic factors, it is crucial to focus on improving healthcare conditions and working environments for this population to reduce the risk of PMDD. By providing additional medical resources and psychological support, as well as improving working conditions, low-income women can effectively help alleviate their PMDD symptoms and enhance their quality of life.

One study suggested that hormonal changes during the menstrual cycle may be associated with premenstrual anxiety [20]. The present study showed that the menstrual cycle was an independent influencing factor of PMDD in adult working women because estrogen and progesterone levels fluctuate during different phases of the menstrual cycle. These hormonal changes have implications for mood and behavior. In regular cycles, luteinizing hormone (LH) levels only increase after ovulation and decrease before the

beginning of menstruation. This regular cycle activity helps to maintain normal hormonal balance, thereby reducing effects on mood and behavior.

The results of this study showed that menstrual symptoms constituted an independent risk factor for PMDD in adult working women. The manifestations of menstrual symptoms exhibit significant inter-individual variability and may encompass a range of somatic discomforts, including abdominal pain, back pain, breast tenderness, fatigue, headache, appetite change, and edema. In addition, a subset of women may experience mood changes, such as anxiety, depression, irritability, and mood lability. Studies have found a correlation between the severity of menstrual symptoms and both the presence and intensity of PMDD [21,22]. Specifically, women may experience increased anxiety symptoms during the premenstrual phase. This situation may exacerbate the subjective perception of menstrual symptoms.

The findings of this study elucidate that physical activity and caffeine consumption function as independent influencing factors of PMDD in adult working women. These results are consistent with the research conducted by Çoban *et al.* [23], who found a statistically significant correlation between lifestyle factors and premenstrual anxiety. Physical activity has been demonstrated to play a crucial role in mood regulation and anxiety reduction. Moderate physical activity can release endogenous neurotransmitters, particularly endorphins, which are associated with improved mood states and attenuated anxiety levels. Regular physical activity has been demonstrated to contribute to menstrual cycle regulation, improve cardiovascular function, and alleviate premenstrual emotional symptoms. However, in adult working women, the regularity of physical activity may be affected by work and life stresses, potentially resulting in insufficient physical activity and, consequently, an increased risk of PMDD. Therefore, encouraging working women to engage in regular physical activities, such as walking, yoga, or other suitable forms of exercise, can help alleviate premenstrual anxiety symptoms. Second, the observed significant correlation between caffeine intake and PMDD may be related to the stimulatory effects of caffeine on the central nervous system. Caffeine, a psychoactive compound classified as a stimulant, has been demonstrated to transiently alleviate fatigue and increase cognitive alertness. However, excessive intake may lead to hyperactivation of the central nervous system, potentially triggering or exacerbating anxiety symptoms. A previous study found a correlation between elevated caffeine intake and the manifestation of anxiety-related symptomatology [24]. In this study, women who consumed large amounts of caffeine exhibited a greater propensity for experiencing symptoms

consistent with PMDD compared to their low-consumption counterparts. This observation suggests that reducing caffeine intake may help decrease the incidence of premenstrual anxiety.

This study has some limitations. First, the cross-sectional design of the study can reveal associations between factors, such as physical activity and caffeine intake, and PMDD, but cannot determine causality. Therefore, future longitudinal studies are needed to verify the causal effects of factors on PMDD. Second, the data in this study relied on self-reported questionnaires, which may introduce information bias. The veracity of respondents' answers may be compromised by recall bias or social desirability effects, potentially affecting the validity of the results. Additionally, despite the implementation of rigorous quality control measures during questionnaire design, the potential for measurement errors cannot be eliminated. Third, this study did not consider other potential influencing factors of PMDD, such as genetic factors, psychosocial stress, dietary habits, sleep quality, and other lifestyle factors. The omission of these factors may limit the interpretation and generalizability of the results. Therefore, future research should include additional potential influencing factors to facilitate a more comprehensive analysis. Moreover, this study did not thoroughly explore the specific types and doses of physical activity and caffeine intake that affect PMDD. Different types of physical activity (such as aerobic exercise and strength training) may have different effects on PMDD. Lastly, this study only involved specific communities in Hangzhou City and cannot represent working women across the country or other regions. The generalizability of the findings may be constrained by regional culture, economic conditions, and social backgrounds. Future research should further refine these variables to generate more targeted and applicable recommendations.

Conclusions

By surveying adult working women, this study determines that the prevalence of PMDD in the surveyed population is 3.04%. Multiple independent variables are identified as significant factors influencing PMDD, including age, age at menarche, income level, menstrual cycle, menstrual symptoms, physical activity, and caffeine intake. Despite some limitations, the findings of this study provide valuable insights for clinical practice. Future research should further explore the causal relationships between the aforementioned factors and PMDD to provide more comprehensive information.

Availability of Data and Materials

Data to support the findings of this study are available on reasonable request from the corresponding author.

Author Contributions

HW, YY and WS designed the research study. HW and WS performed the research. WS, HW and YY collected and analyzed the data. HW and YY participated in drafting the manuscript. All authors contributed to important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The protocol was approved by the Clinical Trial Ethics Review Committee of Shulan (Hangzhou) Hospital (approval number: KY2023018). This study was conducted in accordance with the Declaration of Helsinki.

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Conflict of Interest

The authors declare no conflict of interest.

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